

AMENDMENTS TO THE CLAIMS

1. (Currently Amended): A residual image eliminating apparatus for a liquid crystal display device, comprising:

a plurality of gate lines and a plurality of data lines arranged in the liquid crystal display and crossing with respect to each other, wherein thin film transistors defining liquid crystal cells are connected to the plurality of gate lines and the data lines to switch image signals applied to the liquid crystal cells; and

level shifting means for receiving a power supply voltage and a ground voltage to apply a gate-off voltage first voltage level for turning off the thin film transistors to the gate lines upon power-on and to apply a higher voltage level than the ground voltage to the gate lines upon power-off, wherein the level shifting means includes:

12 a zener diode for applying a negative input voltage lowered by its breakdown voltage to each one of the gate lines; and ←

a transistor connected between the each one of the gate lines and the ground voltage to switch a current path to bypass a voltage at the gate line to the ground voltage during power-off; and

19 a capacitor connected between the ground voltage and a gate-on voltage for charging electric charge with the gate-on voltage until a time of power-off and for applying a voltage higher than the ground voltage to the each one of the gate lines upon power-off, and wherein said gate-on voltage enables said thin film transistors, ←
←

2. (Currently Amended): The residual image eliminating apparatus of claim 1, wherein the gate-off voltage first voltage level has a lower voltage level than a minimum value of the image signals.

3. (Currently Amended): The residual image eliminating apparatus of claim 1, wherein the gate-off voltage first voltage level is a voltage applied to the gate lines when the liquid crystal display panel is in operation.

4. (Original): The residual image eliminating apparatus of claim 1, wherein the level shifting means includes:

means for charging electric charges upon power-on of the liquid crystal display panel;
and

voltage selecting means for allowing a voltage charged in the charging means to be applied to the gate lines upon power-off of the liquid crystal display panel.

5. (Currently Amended): The residual image eliminating apparatus of claim 1, wherein the level shifting means ~~[[includes]]~~ allows a voltage level at the gate line to be raised into a voltage level between the ground voltage and a threshold voltage of the thin film transistors during power-off.

6. (Cancelled).

7. (Currently Amended): The residual image eliminating apparatus of claim 1 ~~[[6]]~~, wherein the level shifting means further includes:

a first resistor for preventing an electric charge charged in the capacitor from being leaked into the gate line when the input charge voltage is charged into the capacitor; and

a second resistor for preventing a voltage at the gate line from being applied to the transistor during power-off.

8. (Currently Amended): The residual image eliminating apparatus of claim 1 ~~[[6]]~~, wherein the level shifting means further includes:

an alternating current voltage source for supplying an alternating current voltage to the gate lines; and

a coupling capacitor for eliminating a direct current component included in the alternating current voltage.

9. (Currently Amended): A residual image eliminating method for a liquid crystal display device including thin film transistors connected between gate lines and data lines to switch image signals applied to liquid crystal cells, the method comprising the steps of:

receiving a power supply voltage and a ground voltage ^{to generate and} to apply a gate-off voltage first ←
voltage level for turning off the thin film transistors to the gate lines upon power-on;

accumulating electric charges ~~using a capacitor connected to a gate-on voltage during power-on; and~~ with a gate-on voltage during power-on by using a capacitor connected between a ground voltage and said gate-on voltage, said gate-on voltage enabling the thin film transistor;

boosting the gate-off voltage to a higher level voltage than the ground voltage;
and applying a higher level voltage than the ground voltage to the gate lines upon power-off.
said

10. (Currently Amended): The residual image eliminating method of claim 9, wherein the step of applying said higher level voltage ~~raising a voltage~~ at the gate lines to higher than the ground voltage includes:

~~accumulating electric charges during power-on; and~~

discharging the accumulated electric charges into the gate line during power-off.

11. (Currently Amended): A device for eliminating residual images on a liquid crystal display device having gate lines and data lines intersectingly arranged to form liquid crystal cells, each liquid crystal cell having a thin film transistor, the device comprising:

a gate low voltage selector ~~a gate voltage generator~~ having a transistor connected between a first voltage source and a second voltage source to generate a gate-off voltage at an output; and

an electric charge accumulator ~~a voltage enhancing device~~ having a capacitor coupled to the output of the gate low voltage selector and the second voltage source, the capacitor is

connected between a gate-on voltage source and the second voltage source, wherein when the first voltage source is turned on, the capacitor is charged ^{with the gate-on voltage source} and when the first voltage source is

turned off, the capacitor boosts the gate off voltage at the output to be higher than a threshold

voltage of the thin film transistor. ^{wherein the gate-on voltage enables}
the thin film transistor.

12. (Currently Amended): The device of claim 11, wherein the gate low voltage selector gate ~~voltage generator~~ includes a diode connected between the first voltage source and the transistor, and the electric charge accumulator ~~voltage enhancing device~~ includes a resistor connected in series with the capacitor, wherein ~~the capacitor is connected between a gate-on voltage source and the second voltage source~~ and the values of the resistor and the capacitor define an RC time constant.

13. (Original): The device of claim 12, wherein the diode is a zener diode and the transistor is a PNP type transistor.

14. (Currently Amended): The device of claim 12, the gate low voltage selector ~~gate voltage generator~~ further including an alternating current source coupled to the output through a coupling capacitor to filter out DC components of the alternating current source.

15. (Currently Amended): The device of claim 11, wherein the gate low voltage selector ~~gate voltage generator~~ includes a resistor connected between the [[a]] gate-on voltage source and the transistor, and the electric charge accumulator ~~voltage enhancing device~~ includes a resistor connected in series with the capacitor, ~~wherein the capacitor is connected between a gate-on voltage source and the second voltage source.~~

16. (Original): The device of claim 15, wherein the values of the resistor and the capacitor define an RC time constant.

17. (Original): The device of claim 16, wherein the capacitor is charged during a normal operation of the liquid crystal display device and discharged when the gate-on voltage source is turned off.

18. (Original): The device of claim 17, wherein the transistor is an NPN type transistor.

19. (Currently Amended): A liquid crystal display device having a device for eliminating residual images, comprising:

gate lines and data lines intersectingly arranged to form liquid crystal cells, each liquid crystal cell having a thin film transistor;

a gate driver connected to the gate lines to enable thin film transistors connected to the gate lines;

a gate high voltage generator ~~a gate-on voltage generator~~ that produces a gate-on voltage to enable thin film transistors;

9 a gate low voltage ^{selector} generator ~~a gate-off voltage generator~~ having a transistor connected between a first voltage source and a second voltage source to generate a gate-off voltage at an output; and

an electric charge accumulator ~~a voltage enhancing device~~ having a capacitor coupled to the output and the second voltage source, the capacitor connected between a gate-on voltage and

← (See claim 11)

- 14 the second voltage source wherein when the first voltage source is turned on, the capacitor is
15 charged ^{with the gate-on voltage} and when the first voltage source is turned off, the capacitor boosts the gate off voltage ←
16 at the output to be higher than a threshold voltage of the thin film transistor. ^{wherein said} ←
^{gate-off voltage and said gate-on voltage disables and enables the} ←
^{thin film transistor, respectively.} ←
20. (Currently Amended): The liquid crystal display device of claim 19, wherein the gate low
2 ^{selector} voltage ~~generator~~ includes a diode connected between the first voltage source and the transistor, ←
and the electric charge accumulator ~~voltage enhancing device~~ includes a resistor connected in
series with the capacitor, wherein ~~the capacitor is connected between a gate-on voltage and the~~
~~second voltage source~~ and the values of the resistor and the capacitor define an RC time
constant.
21. (Original): The liquid crystal display device of claim 20, wherein the diode is a zener diode
and the transistor is a PNP type transistor.
22. (Currently Amended): The liquid crystal display device of claim 20, the gate low voltage
2 ^{selector} ~~generator~~ further including an alternating current source coupled to the output through a ←
coupling capacitor to filter out DC components of the alternating current source.
23. (Currently Amended): The liquid crystal display device of claim 19, wherein the gate low
2 ^{selector} voltage ~~generator~~ includes a resistor connected between the ^{[[a]]} gate-on voltage and the ←
transistor, and the electric charge accumulator ~~voltage enhancing device~~ includes a resistor
connected in series with the capacitor, ~~wherein the capacitor is connected between a gate-on~~
~~voltage source and the second voltage source.~~
24. (Original): The liquid crystal display device of claim 23, wherein the values of the resistor
and the capacitor define an RC time constant.
25. (Original): The liquid crystal display device of claim 24, wherein the capacitor is charged
during a normal operation of the liquid crystal display device and discharged when the gate-on
voltage source is turned off.

Application No.: 09/353,847

Docket No.: 8733.085.00-US

26. (Original): The liquid crystal display device of claim 25, wherein the transistor is an NPN type transistor.